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ABSTRACT

Reading Grade Levels (RGLs) of 185 Rate Training Manuals (RTMs) and 188 Non-Resident Career Courses (NRCCs) were determined using the Flesch Reading Ease Score. Results indicated that the majority of the RTMs and NRCCs were written at the lower college grade level. The RGLs vary widely within each RTM and NRCC, ranging from the seventh grade to the college graduate level in many cases. It is recommended that the RGLs be interpreted with caution, because the relationship of reading grade levels and performance effectiveness has not been well established for any reading formula. Methods that could be used to improve the validity of reading formulas, as well as to determine factors involved in the reading skill development of experienced Navy personnel, are presented. (Author/AA)

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CNETS REPORT 2-75

READING GRADE LEVELS OF NAVY RATE TRAINING MANUALS AND NON-RESIDENT CAREER COURSES

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This CNETS in-house task was assigned to flesh out the reading grade levels (RGLs) of 185 Rate Training Manuals (RTMs) and 188 Non-Resident Career Courses (NRCCs). After reviewing a number of formulas used for measuring RGLs, a decision was made to use the Flesch Reading Ease Score for convenience and reliability, as well as compatibility with a current CNTECHTRA reading measurement analysis. A counting device was also (continued reverse side)

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20. developed to make the collection of data points (syllables, words, and sentences) more rapid and reliable. In addition, extensive and precise standards had to be established for delimiting the data points and for selecting sample passages. Both the device and standards resulted in high levels of reliability in data collection. An analysis of the data points using the Flesch Reading Ease Score showed that the majority of the RTMs and NRCCs were written at the lower college grade level. These scores were subsequently corrected using the Kincaid formula, which was developed from the reading grade levels necessary for Navy enlisted personnel to comprehend sample passages taken from Navy RTMs. These corrections indicated that most of the RTMs and NRCCs were written around the 13th grade level. The results also show that RGLs vary widely within each RTM and NRCC, ranging from the seventh grade to college graduate level in many cases. Additional evidence shows that the reliability of reading grade levels for the NRCCs is less than that for the RTMs because fewer samples were used in analyzing the NRCCs. The recommendation is made that these RGLs be interpreted with caution because the relationship of reading grade levels and performance effectiveness has not been well established for any reading formula, especially over a wide range of reading skill levels. In addition, little evidence is available on the reading skill levels of experienced Navy personnel, so the discrepancy between reading skill levels and RGLs may not be as large as assumed from previous research. Methods which could be used to improve the validity of reading formulas, as well as for determining factors involved in the reading skill development of experienced Navy personnel, are presented.

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R.L. SCOTT

CNETS REPORT 2-75

READING GRADE LEVELS OF NAVY RATE TRAINING MANUALS AND NON-RESIDENT CAREER COURSES

PREPARED FOR

THE CHIEF OF NAVAL EDUCATION AND TRAINING SUPPORT

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ACTING AS REPORTER FOR

THE READABILITY WORKING GROUP

C. J. BARRON, CHAIRMAN

MAY 1975

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1.0 Summary. This CNETS in-house task was assigned to flesh out the reading grade levels (RGLs) of 185 Rate Training Manuals (RTMs) and 188 Non-Resident Career Courses (NRCCs). After reviewing a number of formulas used for measuring RGLs, a decision was made to use the Flesch Reading Ease Score for convenience and reliability, as well as compatibility with a current CNTECHTRA reading measurement analysis. A counting device was also developed to make the collection of data points (syllables, words, and sentences) more rapid and reliable. In addition, extensive and precise standards had to be established for delimiting the data points and for selecting sample passages. Both the device and standards resulted in high levels of reliability in data collection. An analysis of the data points using the Flesch Reading Ease Score showed that the majority of the RTMs and NRCCs were written at the lower college grade level. These scores were subsequently corrected using the Kincaid formula, which was developed from the reading grade levels necessary for Navy enlisted personnel to comprehend sample passages taken from Navy RTMs. These corrections indicated that most of the RTMs and NRCCs were written around the 13th grade level. The results also show that RGLs vary widely within each RTM and NRCC, ranging from the seventh grade to college graduate level in many cases. Additional evidence shows that the reliability of reading grade levels for the NRCCs is less than that for the RTMs because fewer samples were

used in analyzing the NRCCs. The recommendation is made that these RGLs be interpreted with caution because the relationship of reading grade levels and performance effectiveness has not been well established for any reading formula, especially over a wide range of reading skill levels. In addition, little evidence is available on the reading skill levels of experienced Navy personnel, so the discrepancy between reading skill levels and RGLs may not be as large as assumed from previous research. Methods which could be used to improve the validity of reading formulas, as well as for determining factors involved in the reading skill development of experienced Navy personnel, are presented.

2.0 Acknowledgements. This report represents the dedicated and often ingenious efforts of several key CNETS and NAVEDTRA-PRODEVCEN personnel. Perhaps the most tireless and significant contributions were made by Mr. Walter Birdsall who, as Project Manager for NAVEDTRAPRODEVCEN, was instrumental in conceptualizing the counting device, and carefully managed the collection of data from unclassified RTMs and NRCCs, as well as the statistical analyses for all RTMs and NRCCs. Mr. Birdsall also established many of the standards which were used in collecting the data. The services of Mr. C. J. Barron, who was Project Manager for CNETS and chairman of the Readability Working Group, is appreciated. Mr. Barron, in addition to these important duties, provided major assistance in designing the counting device and in managing the data collection for classified materials. Appreciation is also extended to those of the Readability Working Group who recommended and provided justification for specific techniques and procedures. These included (in addition to Mr. Birdsall and Mr Barron): Mr. W. L. Behrens, LCDR Biersner, Mr. G. R. Bunde, Dr. A. R. Fregly, Mr. V. E. Frey, Dr. W. C. McClellan, and Mr. W. T. Skipper. Special appreciation is extended to those members of the Working Group and others in CNETS Code N-33 who collected data from the classified materials. These were Mr. Barron, Mr. Behrens, LCDR Biersner, Mr. W. E. Blasingame, Mr. Bunde, Mr. R. D. Craig, Mr. Frey, Mr. S. R. Murphy, and Mr. Skipper. The data collation and statistical

services provided by Mr. R. Doucette, Mrs. Francis Connor and Mrs. Shirley Biggs of NAVEDTRAPRODEVCEN were invaluable and are greatly appreciated, as was the extensive programming support provided by Miss A. Lucille Shirk.

3.0 Purpose. This report will present the reading grade levels for the Navy Rate Training Manuals and Non-Resident Career Courses which were in the mid-1974 inventory of the Chief of Naval Education and Training Support. The two techniques used to determine reading grade levels — the Flesh Reading Ease Score and the Kincaid Formula — will be described, and recommendations will be made about the usefulness of the results obtained from these two techniques.

4.0 Background. In a recent technical report (see reference 1), Carver found that a sample of 20 Navy Rate Training Manuals (RTMs) were written, on the average, at the 14th grade level. These findings indicated that those who read these manuals would have to read at the college sophomore level in order to comprehend the information contained in the average RTM. An additional report by Carver (see reference 2) showed that the entering Navy recruit reads at slightly over the ninth grade level. This finding was later replicated on recruits at the Recruit Training Center, San Diego (see reference 4). Carver mentions that findings on the reading difficulty of RTMs must be interpreted with caution because an insufficient number of passages were used to determine the reading grade level (RGL) for each manual. In addition, it was not known whether these 20 manuals were representative of all RTMs, or whether some unknown factor may have been involved in selecting only the more difficult manuals for

analysis. Despite these precautions, it was evident that a discrepancy may exist between the reading grade levels of RTMs and those who must read the RTMs to qualify for rate or advancement in rate.

In order to reliably determine the reading grade levels of these written materials, CNETS letter 00:jdc of 7 June 1974 requested that "action be taken to develop and implement a plan to establish the reading grade levels of all rate training manuals, basic manuals, and...non-resident courses" for which the CNETS has management and publishing responsibility. In response to this request, a Readability Working Group was formed. The composition, purposes and initial actions of this group are described in CNETS memorandum for the project manager Code N3314:pc of 13 June 1974. The second meeting of the Readability Working Group resulted in CNETS memorandum to the project manager Code N3314:pc of 20 June 1974 which recommended the techniques to use in determining RGLs, as well as some preliminary cost estimates. Although this memorandum recommended the Automated Readability Index (ARI) as the formula to use in determining RGLs, the group later decided that the ARI would have been too costly for the limited scope of the analysis. In addition, procurement of parts (especially counters) necessary to modify an electric typewriter to an ARI configuration may have taken as long as six months. This second memorandum also identifies NAVEDTRA-PRODEVCEN as being the best resource within CNETS to manage the data collection and to perform the statistical analyses

because of the availability of computer support, statisticians and statistical technicians, and most importantly, the subject matter experts who compose and revise the RTMs and NRCCs. NAVEDTRAPRODEVCEN was requested to provide this assistance in CNETS letter Code N2131:kjs of 19 July 1974. This letter specified (a) that the Flesch Reading Ease Score (see reference 5) be used in measuring RGLs, (b) that an electro-mechanical counting device was to be developed and used as an aid in counting syllables, words, and sentences, (c) that the sample passages used for determining RGLs must conform to specific standards (some of which differed between the RTMs and NRCCs) and (d) that the collection of data points (syllables, words, and sentences) had to be highly reliable, and that the level of reliability should be statistically demonstrated. Each of these specifications will be discussed separately and more extensively in the Methods section (see paragraph 5.0).

Some precautions should be made, however, before proceeding further. As will be shown in later sections, the standards used to measure RGLs were often arbitrary, and the relationship between RGLs (as determined by any of the reading formulas which are available) and reading comprehension or performance effectiveness is not well established, despite the apparent importance of reading to the development of most other skills. Reading skills are dependent on a number of factors, including visual acuity and scan, intelligence, cultural and social background, motivation for the subject

matter, the availability of others to explain written material, a social/organizational climate which provides an opportunity to read important materials, and so forth. In establishing and implementing policy based on RGLs, it is important to remember that comprehension of material written at a specific RGL is dependent on the presence or absence of these factors, and will vary accordingly. As visual and intelligence problems are identified and corrected, and as more opportunities are provided during childhood and adolescence to read more widely and extensively, the understanding of material with high RGLs will be improved. In addition, another factor which has not been analyzed in determining RGLs is writing style — the form in which written information is presented so as to be logically interrelated, as well as interesting to the reader. Effective writing style places information in a logical and accessible format without being redundant, and uses terms and examples which are familiar and interesting to the reader without sacrificing meaning and comprehension. Writing style makes it possible for different material written at the same RGL to be understood with ease or difficulty. At present, none of the formulas used to measure RGL have incorporated style factors which are convenient, valid or unique for measuring reading effectiveness. This shortcoming is probably the result of the unreliabilities and technical difficulties involved in measuring writing style factors. Many of these difficulties will eventually be overcome with advancements in computer technology. This topic will be

discussed further in paragraph 7.0. For the present, however, it is only important to recognize that RGL is variable and dependent on a number of factors, the most important of which may be writing style. The following methods and results should be interpreted in this context.

5.0 Methods. The following techniques, standards, procedures, and analyses were used in determining the reading grade levels for Navy RTMs and NRCCs.

5.1 Selection of the Flesch Reading Ease Score. The Readability Working Group thoroughly reviewed the numerous techniques and formulas which are available for measuring RGLs. Included were the ARI, Fog, Cloze, Dale-Chall, Forcast, RIDE, and Flesch. The Flesch Reading Ease Score was adopted because of the following factors:

(a) It correlates consistently and highly with other readability measures, and also appears to be highly correlated with measures of reading comprehension such as the Cloze and Bormuth techniques (see reference 3).

(b) Complex equipment is not required in order to collect data points (syllables, words, and sentences), although simple devices have been developed which have proven effective in making data collection more rapid and reliable (see reference 8). Several techniques, such as the Dale-Chall, require that word lists be accessed. This procedure is too laborious to use in analyzing the thousands

of samples which were involved in the present task. These accessing techniques will eventually be performed by computers, but even this advancement will probably remain an expensive option to others which are available.

(c) Inasmuch as devices could be used to aid in counting data points, training and practice requirements were reduced.

(d) The results of this task would also be compatible with a CNTECHTRA task to validate several reading formulas on Navy enlisted personnel (see reference 7). This CNTECHTRA task corrected the Flesch, Fog and ARI formulas in accordance with the reading grade levels required by Navy personnel to understand passages selected from 13 RTMs.

In addition to the above factors, it should be mentioned that the Air Force Human Resources Laboratory (see reference 11) had recently completed an extensive review of major reading formulas, and concluded that "if reference to a word list was to be avoided, the Flesch formula was recommended."

5.2 Application of the Flesch Reading Ease Score. The specifications for determining which passages were to be selected from the RTMs and NRCCs for collection of data points were provided in the CNETS tasking letter to NAVEDTRAPRODEVCEN. These specifications are listed separately for the RTMs and NRCCs in Appendix A. The selection of sample passages from each RTM chapter and NRCC assignment was, therefore, randomly determined. These specifications

were necessary because written material varied in a uniform fashion and did not conform well to the standards originally established by Flesch (see references 5 and 6). For example, the first chapter in most manuals deals with the same introductory information and is written in the same format. It is so uniform among manuals that it is commonly referred to as "boilerplate." Pages within chapters also contain material which is not written in a conventional prose format. This latter material includes procedural information and consists of incomplete sentences, equations, diagrams, and so forth. In addition, different writers are used to compose or revise RTMs and NRCCs, so at least one sample passage was selected from each RTM chapter and NRCC assignment in order to obtain a more even distribution of different writing styles. These specifications, by avoiding frequent use of redundant passages, or passages which may have been written using a predominant writing style, established RGLs which better represent the unique reading characteristics of each manual. It should also be mentioned that the question-answer format used in writing the NRCCs presented special problems which could only be overcome by establishing arbitrary specifications. The NRCCs varied the most from conventional prose style, and procedures had to be established for making this material

conform as much as possible to the original standards established by Flesch for prose material.

Although the above specifications provided adequate guidelines for the selection of sample passages, it was later found that additional specifications would be required in order to reliably collect data points (syllables, words, and sentences). As mentioned above, the original Flesch standards were appropriate for conventional prose and were not developed for the technical terms and styles used in RTMs and NRCCs. The writers of RTMs and NRCCs make frequent use of acronyms, abbreviations, punctuations, numbers (decimals, fractions, headings, and so forth), and occupational jargon which are not typical of narrative prose. Standards had to be provided which could be used in determining whether these terms could be classified as words, and if so, the method to use in dividing these terms for syllable count. In addition, standards had to be established which specified the conditions under which phrases, or even single words enclosed between punctuations, could be classified as sentences. These sentence specifications had to be made because exclamatory sentences consisting of single words were occasionally found. Phrases and clauses which were structurally complete sentences (subject, verb, and object), but which ended in colons or semi-colons instead of periods, were also found. In a few cases, incomplete sentences had to be analyzed.

These standards provided the personnel who collected the data points (counted the syllables, words, and sentences) with a uniform set of rules which helped to speed the counting process by reducing the number of decisions that had to be made about unusual or difficult syllables, words, and sentences. These standards also did much to improve the reliability of the data collection process. A list of these standards, and examples of each, are presented in Appendix B. Also listed are syllable counts for words which were frequently encountered and which were especially difficult to analyze for syllables. These words had either more or fewer syllables than could be accurately determined from normal pronunciation. The authoritative resource used in resolving problems of syllable count was Webster's New International Dictionary, Unabridged, Second Edition, published in 1951. It was found that this resource divided words according to established rules of English spelling and grammar, while more recent dictionaries (including Webster's) divide words according to standards used in lithography.

5.3 Counters. These were the personnel who collected the data points. Collection of data points involved counting and documenting the number of syllables, words and sentences for each of the sample passages which had been pre-selected by the NAVEDTRAPRODEVCEN Project Manager.

Those who applied to be counters had to be high school graduates and speak and write English fluently.

These screening factors eliminated those who would have had difficulty reading and collecting data from the sample passages. In addition, applicants were asked to read aloud from the Opticalman 1 and C manual, page 114, first paragraph under "Operation." This was done to insure that they did not have any reading difficulties. Those who passed this screening procedure were then asked to count the number of syllables in the term "180°" which is located in the second sentence of this passage. (The correct answer is seven - one/hun/dred/eigh/ty/de/grees.) Those who performed this count successfully were then asked to count the total number of syllables and words in the first sentence of the passage. They were not provided with any instructions for performing these counts.

Of the 33 applicants who were screened, 16 were selected as counters. This group consisted of 15 females and one male, ranging in age from 18 to 56 years (average= 32.25 years). They had from 12 to 18 years of education (average= 14.5 years), and were either housewives or college students. Each of these 16 counters collected data from the RTMs and NRCCs for four hours a day over an 8-week period. During the last several weeks some of the counters requested, and were granted, an 8-hour day. These requests indicate that motivation among the counters remained high despite the redundancy of the task and low pay ($2.73/hr). Several factors seemed to be involved in this high level of motivation,

including: (a) They were convinced that the results of the analysis were important to the Navy, (b) the Project Manager encouraged the counters to identify problems for arbitration and standardization, (c) these problems were rapidly solved and the solutions were documented and made available to the entire group, and (d) emphasis was placed on productivity and accuracy, which helped to provide the counters with pride in the way they performed the task. In addition, the counters were provided with a 10-minute rest period every hour, which they took singly or in pairs to avoid lengthy group interactions. The temporary status of the task also provided it with a forseeable end, which is probably an important factor under these redundant conditions. These factors are mentioned because the reliability of results under these conditions is highly dependent on the motivation of those who are collecting the data, and the level of cooperation which they demonstrate as a group.

These sixteen counters were only responsible for collecting data points from unclassified materials because they did not have the security clearance required to analyze classified documents. The task of analyzing classified material was performed by a second group of nine counters. This second group consisted of personnel from the Readability Working Group and other volunteers who were familiar with manual writing and production. Again, volunteers are essential because of motivational factors involved in reliability.

All but one of this second group were civil servants rated at or above the GS-11 level. The single exception was an 0-4 Navy officer. This second group counted the syllables, words and sentences of sample passages for several hours a day during regular duty hours. These sample passages were selected and analyzed using the same standards and techniques used by the first group for unclassified materials. Inasmuch as this second group followed the first, they had the benefit of many of the standards developed during analysis of the unclassified materials, which made for high reliability between the two groups (see paragraph 6.2).

5.4 Counting Device. The conventional procedure for counting syllables, words, and sentences requires the counter to manually divide words into syllables using a pencil. After counting syllables, they return to the beginning of the sample passage and count the total number of words, and then the total number of sentences. This procedure adds to the unreliability and inconvenience of the data collection process because manually dividing words is extremely cumbersome, while trying to remember the total count can be difficult, especially if the counter has to pause during the counting process and resolve a problem about sentence structure or word division. In order to overcome these difficulties, the Readability Working Group decided that a device should be developed which would make manual division of words unnecessary, and provide for a

running total of syllable, word or sentence counts as the counter progressed through the sample passage. A device which met these specifications had been previously developed (see reference 8). Research on this device showed that it made data collection over 30 percent faster, while maintaining high reliabilities. It was decided, however, not to adopt this device for the present analysis because it used an electronic metronome to establish a constant speed or pace for counting, which forced the counter to read at a rate of one syllable per metronome signal. This signal actuated an electronic counter which totalled the number of signals delivered while reading the syllables in a sample passage. Although this technique freed the counter from manually dividing the words into syllables, it might have presented problems if the counter came across a difficult word (or words) and had to progress more slowly. Another device was subsequently developed which was operated directly by the counter, and was therefore adaptable to the different speeds at which the counters might progress through the sample passages. In addition, it was simpler and less costly than the original device, consisting of a push-rod housed in a nylon-tip pen casing (referred to as a stylus), a microswitch (also housed in the casing), and an electro-mechanical counter (see Figure 1). By pressing the stylus against the manual, the push-rod tripped the microswitch which in turn activated the electro-mechanical counter. A spring then

forced the push-rod back to the starting position, ready for another count. This device was easy to operate because it could be held in the hand like a pencil. By pointing at each word, progress through the sample passages could be easily tracked. If the counter had to stop, this position could be marked and returned to after the problem had been resolved. This could be done without having to start or stop a metronome. Advantages of this device are that it does not require much training to use, and the parts can be commercially purchased and locally assembled.

5.5 Data Collection and Analysis. After the counters totalled the number of syllables, words and sentences for each sample passage, these data points were entered onto a separate data sheet. These data sheets were then collated for each manual and correspondence course. At least 25 sample sheets (a minimum of one per chapter) were collected per manual in accordance with the sampling techniques originally established by Flesch (see references 5 and 6). For manuals with fewer than 25 chapters, additional passages were sampled from several chapters until a total of 25 was obtained. Because of the question-answer format used in writing the NRCCs, only one sample which met the specifications in Appendix A could usually be obtained from each assignment. Inasmuch as fewer than 25 assignments were available in each NRCC, the criterion of 25 samples which was used for the manuals could not be applied to the NRCCs. In some cases,

as few as six samples were taken from an NRCC, but in the majority of cases 10 or more passages were sampled. This difference in sampling techniques between the manuals and NRCCs indicates that the RGLs for the manuals should be more reliable and less subject to measurement error than those of the NRCCs. More confidence can therefore be had in the accuracy of the RGLs for the manuals than for the NRCCs.

The collated data sheets for each manual and NRCC were then analyzed for RGL. The Flesch Reading Ease Score for each sample passage was determined using the following formula:

$$\text{Reading Ease Score} = 206.835 - 1.015\,(\text{words/sentence}) - 0.846\,(\text{syllables/100 words})$$

Each Flesch Reading Ease Score was then converted to Reading Grade Level using the standard conversion table developed by Flesch (see reference 5). The Flesch Reading Ease Scores for all the samples collected from each manual and NRCC were subsequently combined, and the average Flesch Reading Ease Score and Reading Grade Level for each manual and NRCC was determined. The data points used in determining the Flesch Reading Ease Scores for the manuals were also used in a formula recently developed for CNTECHTRA by Kincaid et al. (see reference 7). This formula, which shall be referred to as the Kincaid formula, reads as follows:

$$\text{Reading Grade Level} = 0.39\,(\text{words/sentence}) + 11.8\,(\text{syllables/word}) - 15.59$$

The Kincaid formula may be a more accurate representation than the Flesch formula of the reading grade levels of Navy RTMs. The Kincaid formula was determined from the grade level which was necessary for Navy enlisted personnel to understand sample passages which had been selected from 13 Navy RTMs. The Flesch formula is not based directly on the level of comprehension required to understand written material, but was determined from the grade level at which this material was being used by the readers regardless of comprehension.

The Kincaid formula was not used to convert the Flesch Reading Ease Scores of the NRCCs because the Kincaid formula was developed only from sample passages selected from RTMs. In addition, the fewer number of passages which were sampled from the NRCCs reduces the reliability of any RGL formula (including the Flesch), and this unreliability makes comparisons and differences between formulas highly questionable.

In order to insure that the data points had been collected in a similar and uniform manner among the counters, as well as between the two counting groups, measures of reliability had to be determined. To accomplish this, about ten percent of the original sample passages from the RTMs and NRCCs were recounted by different counters. The number of syllables, words and sentences obtained during the recount of each of these passages was then statistically compared for reliability using Pearson product-moment correlations with the number of syllables, words and sentences obtained during the original

count of these passages. Reliability between the two counting groups (unclassified and classified material) was accomplished by having the second (classified) group recount 19 sample passages which had originally been counted by the first (unclassified) group. Although more than 19 sample passages should have been recounted to obtain a highly accurate measure of reliability between the two groups, this figure does provide a fair approximation of whether the two groups were consistent in implementing the standards described in paragraph 5.2.

6.0 Results. The following paragraphs contain the data on Reading Grade Levels using both the Flesch and Kincaid formulas, as well as the reliabilities within and between counting groups, and miscellaneous findings.

6.1 Reading Grade Levels. A total of 185 RTMs and 188 NRCCs were anlayzed, including 146 unclassified RTMs, 39 classified RTMs, 149 unclassified NRCCs and 39 classified NRCCs. Three fewer RTMs than NRCCs were analyzed because these were undergoing revision during the data collection period. The total number of sample passages was 9744 for the RTMs and 3943 for the NRCCs. The average reading grade levels (for both the Kincaid and Flesch formulas) of the combined passages sampled from each of the RTMs is presented in Appendix C according to the numerical order of the manual. As this appendix shows, the Kincaid RGL usually corresponded

to the lower RGL of the Flesch range, and was more often below this range than above it. The RGLs for the majority of the manuals using both formulas appear to be at the lower college level (13th and 14th grades). Inasmuch as the Kincaid formula agrees most consistently with the lower Flesch level, the lower level (13th grade) is probably the best estimate of RGL.

The Pearson product-moment correlation between the average Flesch Reading Ease Score and the Kincaid RGL for a random sample of 30 manuals was -0.986, indicating extremely high agreement between the two measures, at least for the relative differences between manuals (see explanatory note, page 32).

It should be emphasized that the RGLs in Appendix C represent the average RGLs of the 25 or more samples that were collected from each manual. Within each manual, however, it was not uncommon to find that these 25 or more RGLs ranged from the seventh grade to college graduate levels. This variance is extremely high, and indicates that the material in the RTMs is not written in a consistent or standardized manner. A corollary analysis which was performed on all the texts used in the sixth, seventh, and eighth grades of the Santa Rosa County (Florida) school system showed that these materials also varied substantially, with RGLs ranging from the sixth grade to the college graduate level.

The reading grade levels (using only the Flesch formula) for the NRCCs are listed in Appendix D according to the numerical order of the NRCC. These RGLs appear to be similar

to those obtained for the RTMs (lower college level). In addition, the average RGL for each NRCC appears to correspond closely to the average RGL of the same subject matter RTM, which provides internal validation of these findings because corresponding chapters and assignments within RTMs and NRCCs are usually written by the same personnel. Again, the variability of RGLs within each NRCC was as high as that for RTMs, indicating that several different standards or procedures are used in composing and revising these materials. The RGLs for the NRCCs may also be elevated because the question-answer format used in NRCCs made for lengthier sentences than is the case for the narrative prose for which the Flesch formula was designed.

6.2 Reliabilities. The reliabilities within and between the two groups (unclassified and classified) for counting syllables, words, and sentences in the RTMs and NRCCs are presented in Table 1 (see following page). All of these reliabilities are at acceptable levels, indicating that the counters within each group, and between the two groups, agreed on the standards used for determining syllables, words, and sentences established in paragraph 5.2. In addition, they implemented these standards accurately and uniformly for both the RTMs and NRCCs. Some improvements, however, could be made in those factors which have correlations below .90. This could probably be done by insuring that the counters are provided with, and fully understand, all of the

TABLE 1

Reliabilities within and between groups for initial count and recount of data points (syllables, words, and sentences).

RIM OR NRCC	GROUP DOING INITIAL COUNT	GROUP DOING RECOUNT	NO. OF SAMPLE PASSAGES RECOUNTED	RELIABILITY OF SYLLABLES	RELIABILITY OF WORDS	RELIABILITY OF SENTENCES
RIM	Unclassified	Unclassified	438	.98	.85	.99
RIM	Classified	Classified	111	.95	.96	.95
RIM	Unclassified	Classified	19	.99	.98	.92
NRCC	Unclassified	Unclassified	445	.94	.96	.97
NRCC	Classified	Classified	95	.88	.93	.86

standards which were used. This misunderstanding probably accounts for the lower reliability for words in RTMs among the unclassified group (.85), and for sentences in NRCCs among the classified group (.86). Reports from counters in the unclassified group indicated that they had problems determining the number of words in proper nouns such as "USS John Paul Jones". (The correct answer is one - several words which name, or are proper nouns for separate entities, are counted as a single word.) They also reported having problems determining whether words such as "sure fire", which are often hyphenated or spelled as a single word, should be counted as one or two words. (The correct answer is two--the words should be counted as printed, whether correct or not.) The counters in the classified group appear to have had some problems determining sentence structure in the NRCCs. This difficulty probably arose because the NRCCs frequently use a question-answer format in which a stem or main question is followed by several distractors. Some confusion appears to have occurred among the classified group as to whether or not the first distractor should be counted as a separate sentence. (The standard in Appendix A specifies that a distractor is never counted as a separate sentence, and is included as part of the stem only if the stem is not punctuated.) Many problems were found to have been prevented, and the reliabilities improved, by having these standards established and well publicized (printed as a

reference source) prior to starting the data collection. It was found that a day or so should be spent training the counters in using these standards and answering questions which they may have about application. Part of this training should involve practice in using these standards on especially difficult passages.

6.3 Miscellaneous Findings. In order to determine whether similar Flesch Reading Ease Scores would have been obtained by using fewer than 25 sample passages per manual (and thereby reducing the workload), the average Flesch Reading Ease Scores for 30 randomly selected RTMs were recalculated using sample sizes of 10 passages. Inasmuch as the smaller sample was contained within the larger sample, and therefore biased the comparisons in favor of not obtaining any differences, the effects of the smaller sample on the larger sample were partialed out prior to making the statistical comparisons. It was found that the average Flesch Reading Ease Scores for only two of the 30 RTMs were significantly different at the .05 level (two-tailed). This is about the number of significant differences that would be expected by chance alone. A comparison of the variability of scores around this average, however, showed that variability was greater for the smaller sample size in 28 of the 30 comparisons. A chi-square test of this difference was highly significant ($X^2=20.83$; $p<.001$; $df=1$). These results indicate that although the average Flesch Reading Ease Score did not differ according to sample size (10 or 25), the

variability of scores around this average was significantly greater for the smaller samples. This greater variability makes estimates of the average Flesch Reading Ease Score which are based on smaller sample sizes more unreliable. This would become a problem if the average Flesch Reading Ease Score was being used to estimate, or was being estimated from, some other measure such as the Kincaid formula. This estimate would be more reliable if 25 samples were used instead of 10 to originally establish the relationship between the two formulas. These findings, therefore, justify the above decision (see paragraph 5.5) not to convert the Flesch Reading Ease Scores obtained for the NRCCs to the Kincaid RGLs because of the unreliabilities which would have resulted. These findings do, however, indicate that the average Flesch RGLs for the NRCCs are similar to those that would have been obtained using a larger sample size, although the variablity of RGLs within each NRCC is significantly greater than would have resulted from using a larger sample size.

7.0 Discussion. These results provide the most thorough analysis of a discrete population of reading material ever accomplished. Virtually every piece of written material which is available to the Navy for non-resident professional development of enlisted personnel was sampled and measured for readability. The basic conclusion from this analysis is

that most of this material is written at the lower college level, usually around grade 13. This figure is lower than that found by Carver (see reference 1), but still above the reading skill levels which Carver established for Navy recruits. Most of this material, however, is not read by recruits, but is read instead by personnel who may have improved reading skills after leaving recruit training. The disparity between the readability of this written material and the reading skill levels of these experienced personnel may, therefore, not be as large as originally assumed. Inasmuch as reading skills above the sixth grade level are highly related to vocabulary development, it seems likely that reading skills specific to Navy material will improve among Navy personnel as they develop a technical vocabulary through experience with supervisors, technical manuals, instructions, and other occupational reading material. This technical vocabulary should then improve comprehension of RTMs and NRCCs. In order to determine whether this assumption is valid, it is recommended that personnel who have been tested for reading skills at the Recruit Training Centers be retested at different intervals to determine whether reading skills are improved with experience. A questionnaire could also be administered which asks for the type and frequency of professional reading they do in order to determine which materials are most responsible for any improvements which may be demonstrated. With these data, reading skill improvement

for Navy personnel could be managed more effectively, and perhaps at lower cost, than by trying to establish more formal training programs without knowledge of these factors. These reading data could also be used to validate the formula which was developed by the Naval Personnel Research and Development Center (see reference 4) to predict reading grade levels from General Classification Test (GCT) scores. This formula was originally developed for recruits, but should be revalidated on more experienced personnel to determine if intervening experience has significantly modified the relationship between reading skill level and GCT.

As mentioned in paragraph 4.0, RGLs determined by any formula should be interpreted with caution because the relationship of RGLs to performance has never been widely demonstrated. The Air Force (see reference 9) has shown that reading material which was written to a lower grade level improved the performance of poor readers on multiple choice tests, but the effects of lower RGLs on the test performance of better readers has not been determined. This determination should be made, however, prior to reducing the overall RGLs of the manuals and NRCCs. The reading skills of personnel in some highly specialized rates is probably at or above the college level because of the high GCT scores required to enter these rates, and a reduction in the RGLs for the manuals associated with these rates may reduce motivation to read. The data provided by the research mentioned in the above paragraph would permit a more valid

determination of those rates in which the discrepancy between reading skill levels and RGLs is the greatest.

Any revision of manuals or NRCCs should not only involve RGLs, but writing style as well. Although RGLs can be reduced by using simpler words and shortening sentences, this may not be the most effective method to use in revising written materials. Writing style must also be analyzed. Major factors or characteristics of writing style should be reliably identified, and research should be undertaken to determine which of these factors are most highly involved in reading effectiveness. Measures of reading effectiveness should not only include improved understanding of the written material, but such factors as whether or not the material is used more often because it is attractive or easier to understand. Unfortunately previous research on effective writing style is sparce, so future research would have to be basic and innovative. This research would, however, be a major contribution to all written communication.

The reading difficulty of manuals and NRCCs as determined by the Flesch Reading Ease Score is a relative measure which varies according to the complexity of the syllables, words, and sentences which are used in composing these materials. The RGLs of these materials vary only in relation to these factors, and the relative difficulty of these materials as presented in this report is based solely on these factors. Other factors, such as writing style, may modify the reading

difficulty of a manual relative to other manuals without any apparent difference in RGL, so caution should be exercised in interpreting these RGLs too literally. This is especially true of those manuals which are not separated by more than one RGL. If manuals are to be revised on the basis of the present results, it is recommended that the manuals be grouped according to relative difficulty level, and that writing problems which exist within these groups be identified for correction. These revisions should also involve other factors in addition to simplifying syllables, words and sentences. These additional factors should include writing style and a consideration of the reading skills of those in the reader population.

The question of the validity of RGLs (regardless of which formula is used) has been mentioned on several occasions in this report. Validity will continue to be a problem until methods can be determined, and criteria established, for measuring reading effectiveness. Until these determinations are made, modifications in any formula are unwarranted, and decisions about which formula to use will continue to be based on convenience, cost, and reliability. The validity of reading formulas must be established before any substantial improvements can be made in writing more effectively. The effectiveness of written materials would appear to be based on more than syllable, word, and sentence complexity. It is highly recommended that those who write and publish Navy

reading materials agree on the criteria and methods to be used in measuring reading effectiveness, and then determine ways in which to improve the reading formulas. Several factors should be explored, including analyses of technical and professional words, high-imagery words which improve perception of subject matter, and personal or "ego" words which may improve interest or motivation for reading material. Lists of words which vary in imagery content have been constructed and validated, and appear to be involved in reading skill development (see reference 10), while the "ego" factor was originally proposed by Flesch to improve readability (see reference 5). For convenience and speed, the text could be typed into a computer and analyzed using a program developed for these analyses. With these, and other advanced techniques, occupational performance will be more effectively trained through reading.

Explanatory Note: According to the conversion procedures developed by Flesch (5), a negative correlation exists between Reading Ease Scores and Reading Grade Levels such that higher Reading Ease Scores are converted into lower RGLs. The negative correlation found between the Flesch Reading Ease Scores and the Kincaid RGLs indicates, therefore, that the RGLs derived from the Flesch Reading Ease Scores under these conversion procedures would correspond positively with the RGLs obtained using the Kincaid formula.

8.0 Conclusions. The following conclusions are presented from this analysis:

a. The reading grade levels (RGLs) of most RTMs and NRCCs appear to be at the lower college level, usually around grade 13.

b. The RGLs determined from the Flesch Reading Ease formula are uniformily higher than those determined from the Kincaid formula which was developed and validated on Navy personnel samples.

c. The RGLs within RTMs and NRCCs were found to vary substantially, often ranging from the seventh grade to college graduate levels.

d. Speed, accuracy and reliabilities were improved as a result of using electro-mechanical counters, and by establishing strict specifications and standards for the selection of sample passages and the collection of data points.

e. Reliability of average RGLs is improved by using at least 25 sample passages for each RTM and NRCC instead of ten passages.

f. Motivational factors are also important for reliability of data collection.

9.0 Recommendations. The following recommendations are made in conjunction with the above conclusions:

a. The reading skills of experienced Navy personnel should be measured in order to determine whether a disparity exists between the RGLs of RTMs and NRCCs and reading skill levels. This measurement could be performed using a questionnaire designed to document the frequency and type of professional reading which is done by experienced Navy personnel.

b. A determination should be made of the motivational and performance effects which result from reducing RGLs below the skill levels of the readers.

c. Factors other than syllable, word, and sentence complexity which may be associated with reading effectiveness should be explored, especially writing style. Reliable characteristics of writing style should be identified, and research should be conducted to determine which of these characteristics are significantly related to reading comprehension and performance effectiveness.

d. The above research results should be incorporated into a writing technique course for those who compose and revise RTMs and NRCCs. As an interim measure, and editoral board consisting of editorial writers and subject matter experts should be established to review writing style problems which exist in present RTMs and NRCCs. This board should recommend style and composition policies which would be useful and feasible to current RTM and NRCC writers.

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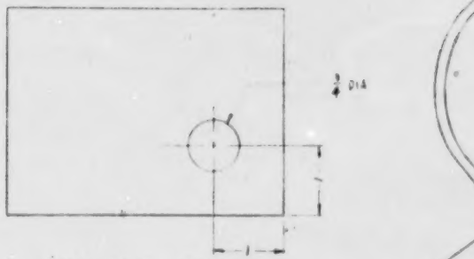
10. Van der Veur, B.W. Imagery rating of 1,000 frequently used words. Journal of Educational Psychology, Vol. 67, pp. 44-56, 1975.

11. Williams, A.R., Siegel, A.I., and Burkett, J.R. Readability of textual materials - a survey of the literature. Air Force Human Resources Laboratory Technical Report 74-29, Lowry Air Force Base, Colorado 80230, July 1974.



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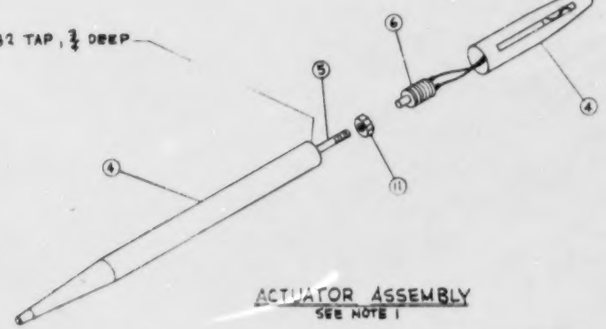
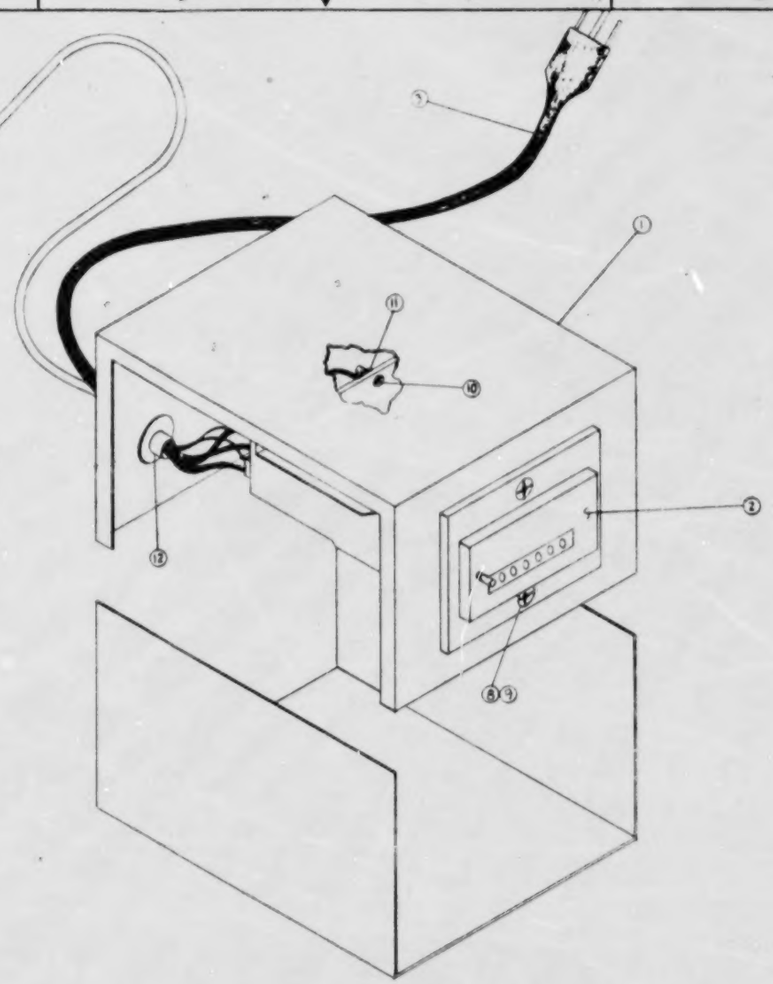


ACTUATOR ASSEMBLY
SEE NOTE 1



ASSEMBLY
NO SCALE

ACTUATOR ROD
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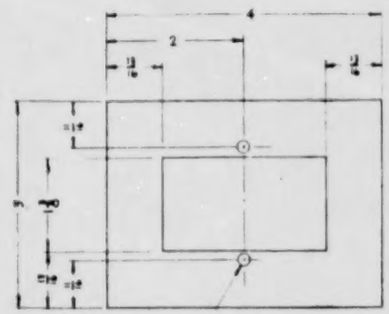

BOX DETAILS - FRONT
SCALE: FULL

NOTES
1. REMOVE INSIDE PORTION OF FELT TIP PEN AND TAP THE END INDICATED TO ACCEPT THE THREADS ON THE SWITCH

ITEM	QTY	FSCM	PART NO.	SPEC-DWG NO	NOMENCLATURE
12	1 EA		2299	5325-263-6691	GROMMET, RUBBER - 1"
11	2 EA		MS35649-242		NUT, HEX #4-40
10	1 EA		MS35206-217		SCREW, #4-40 X 3/8 RD HD
9	2 EA		MS35649-282		NUT, HEX #8-32
8	2 EA		MS35190-255		SCREW, #8-32 X 1/2 C'SK PH
7	3 FT		15538-100		WIRE, 24 AWG, 2 COND, BELDEN
6	1 EA		39-101		SWITCH, GRAYHILL
5	1 EA	89297	ETE-4316-01-1		ROD, ACTUATOR (3/32 WELDING ROD OR EQUIV)
4	1 EA				PEN, NYLON TIP MARKER, SCRIPTO
3	1 EA		6150-00-071-1180		CABLE ASSY
2	1 EA		5X647		COUNTER, ENM BRAND
1	1 EA	ILIB4	CU2105-A		BOX, MOUNTING

MATERIAL LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS DECIMALS ANGLES		NAVAL TRAINING DEVICE CENTER ORLANDO, FLORIDA	
MATERIAL: SEE LIST THIS SHEET	DRAWN S PIVEY 11-12-74	READABILITY COUNTER ASSY & DETAILS	
	CHECKED 11/12/74		
	APPROVED 11/18/74		
NEXT ASSY / USED ON APPLICATION		SIZE D / CODE IDENT NO. 89297 / DRAWING NO. ETE-4316-01	
		SCALE SHOWN	SHEET 1 OF 1

Figure 1 Electro-mechanical Counter

APPENDIX A

SPECIFICATIONS FOR DETERMINING THE SELECTION OF SAMPLE PASSAGES FROM RTMs

Specifications for determining the selection of sample passages from RTMs

1. A single sample passage will consist of not fewer than 100 words and not more than 150 words.

2. One sample passage will be selected from each chapter of a RTM.

3. Sample passages will be selected from one page which is near the middle of the chapter.

4. Sample passages will begin and end with complete sentences.

5. Sample passages will be delimited only by the total number of words (100-150), and the number of paragraphs or partial paragraphs included in the sample passage will be disregarded.

6. All words and sentences in a sample passage must be continuous; that is, all words and sentences must follow each other. Isolated words and sentences will not be selected from a page.

7. The entire sample passage (100-150 words) must be contained on a single page.

8. Sample passages will not contain mathematical formulas or equations.

9. Numbers will be counted as pronounced (as though written completely in words).

10. Hyphens will be disregarded, and the two (or more) words separated by hyphen(s) will be counted as a single word.

Specifications for determining the selection of sample passages from NRCCs

1. Same as #1 for RTMs.

2. One sample passage will be selected from the introductory section, and one sample passage will be selected from each assignment, per NRCC.

3. Sample passages will consist of a sufficient number of multiple choice question items to meet the requirement for 100-150 words.

4. Only multiple choice question items will be sampled which have verbal distractors. Multiple choice question items which consist of matching answer items, pictoral distractors, fill-ins (written completions), and so forth, are to be disregarded.

5. Multiple choice question items with verbal distractors can be classified as: (a) Those which have a stem (main question) ending in punctuation, and (b) those which have an open stem which must be completed by one of the distractors. Distractors will be disregarded in those items which have stems ending in punctuation (classified as (a) above). For items with open stems (classified as (b) above), the first distractor will be counted in order to complete the sentence. The number which identifies this distractor will be disregarded.

6. Sample passages will consist of as many pages as are necessary to obtain 100-150 words.

7. Sample passages will come from pages which are near the middle of an assignment.

8. Same as #8 for RTMs.

9. Same as #9 for RTMs.

10. Same as #4 for RTMs.

11. Same as #10 for RTMs.

Additional specifications for determining the selection of sample passages for both RTMs and NRCCs

1. Disregard numbers which are used to identify paragraphs or sentences.

2. Disregard sentences which contain dependent clauses.

3. Disregard titles or non-punctuated headings to paragraphs or sentences.

4. Introductory information such as learning objectives or punctuated topic headings should be counted if an integral part of the sample passage.

APPENDIX B

STANDARDS USED TO DETERMINE SYLLABLES, WORDS, AND SENTENCES

Standards used to determine
syllables, words, and sentences

1. Syllables

a. Count syllables the way the word is pronounced. For example:

row = /row/= 1 syllable
maintain = /main/tain/ = 2 syllables
dictionary = /dic/tion/ar/y/ = 4 syllables

b. Count symbols, figures, and numbers in the way these items are normally pronounced. For example:

¢ = /cent/ = 1 syllable
R.F.D. = /R/F/D/ = 3 syllables
1918 = /nine/teen/eigh/teen/ = 4 syllables

c. If in doubt about proper syllable count, consult Webster's New International Dictionary, Unabridged, Second Edition, published in 1951.

2. Words

a. Count as a word any numbers, letters, symbols, or groups of letters surrounded by white spaces. The following are examples of single words:

F.O.B.
i.e.
32,008

b. Count hyphenated words, contractions, or words separated by a slash as single words. For example:

second-grade
1/8-in.*
couldn't
on/off

c. Count as a single word any phrase consisting of nouns which designate a single unit or entity — an "it", "she", or "he" can be substituted for the entire phrase. The following examples are single words:

USS John Paul Jones
Admiral David Farragut
San Diego, California

3. Sentences

a. Count as complete sentences any series of words which is grammatically independent of other sentences or clauses, and which represents a complete thought. A period, question mark, exclamation point, semi-colon, and colon usually represent independent clauses (separate thoughts).

"The equipment is ready." (One sentence ending in a period.)

"Where did he go?" (One sentence ending in a question mark.)

"Home." (An independent thought implying that "he went home". Count as one sentence.)

"Help!" (One sentence ending in an exclamation point.)

"The equipment is old because: a. It was issued several years ago. b. It needs constant repair. c. We have no spare parts for it." (The stem is a dependent clause, and the three distractors are independent clauses. Count as three sentences.)

"Which of the three ships met at the appointed hour: USS Alpha, USS Beta, or USS Delta?" (The stem is an independent clause, and the three distractors are a dependent clause which does not represent a complete thought. Count as one sentence.)

b. Incomplete sentences and sentence fragments which are dependent clauses but not grammatically associated with an independent clause are also counted as sentences. For example:

"The aircraft wing." (An incomplete sentence which is counted as one sentence.)

"While repairing the engine." (A sentence fragment which is counted as one sentence.)

"When tightening the bolt." (A dependent clause or sentence fragment which is counted as one sentence.)

The following are examples of syllable and word counts which were established for difficult terms frequently encountered in the RTMs and NRCC.**

1. Acronyms, abbreviations, headings

	No. Words	No. Syllables
and/nor	1	/and/nor/ = 2
CNTT	1	/cen/tech/tra/ = 3
COSAL	1	/col/sal/ = 2
cps	1	/c/p/s/ = 3
		/cy/cles/per/sec/ond/ = 5
Figure 1-1	2	/fig/ure/one/one/ = 4
MILHR	1	/mi/les/per/hour/ = 4
MK 112	2	/mark/one/twelve/ = 3
NAVEDTRA 91234-B	2	/nav/ed/tra/nine/one/two/ /three/four/b/ = 9 (This is the way syllables are normally pronounced for instructions, not quantities.)
NAVPERS 10056	2	/nav/pers/one/ze/ro/ /ze/ro/five/six/ = 9
NAVSANDA	1	/nav/san/da/ = 3
pps	1	/pulse/per/sec/ond/ = 4
psi	1	/p/s/i/ = 3
		/pounds/per/square/inch/ = 4

2. Numbers and fractions

	No. Words	No. Syllables
0.01	1	/point/oh/one/ = 3
		/ze/ro/point/ze/ro/one/ = 6
00277	1	/oh/oh/two/sev/en/
		/sev/en/ = 7
		/ze/ro/ze/ro/two/
		/sev/en/sev/en/ = 9
1/4	1	/one/quar/ter/ = 3
		/one/fourth/ = 2
1/3	1	/one/third/ = 2
#1	1	/num/ber/one/ = 3
10-28 (B)	2	/ten/twen/ty/eight/b/ = 5
12.5	1	/twelve/point/five/ = 3
60±10	1	/six/ty/plus/or/min/us/
		/ten/ = 7
65°	1	/six/ty/five/de/grees/ = 5
100_8	1	/one/hun/dred/to/the/eighth/ = 6
150° F	2	/one/hun/dred/fif/
		/ty/de/grees/fah/ren/heit/ = 10
150	1	/one/hun/dred/and/fif/ty/ = 6
988.2	1	/nine/eigh/ty/eight/point/two/ = 6
		/nine/eight/eight/point/two/ = 5
		/nine/hun/dred/eigh/ty/
		/eight/point/two/ = 8

	No. Words	No. Syllables
1100	1	/e/leven/hun/dred/ = 5
1300	1	/thir/teen/hun/dred/ = 4
7800	1	/sev/en/ty/eight/hun/dred/ = 6
9,122.5	1	/nine/thou/sand/one/ /hun/dred/and/twen/ty/ /two/point/five/ = 12 /nin/ty/one/hun/dred/ /twen/ty/two/point/five/ = 10

3. Words

	No. Words	No. Syllables
any	1	/a/ny/ = 2
average	1	/ave/rage/ = 2
battery	1	/bat/ter/y/ = 3
casualty	1	/cas/ual/ty/ = 3
convenient	1	/con/ven/ient/ = 3
dial	1	/di/al/ = 2
electrically	1	/e/lec/tri/cal/ly/ = 5
evolve	1	/e/volve/ = 2
factory	1	/fac/tor/y/ = 3
fire	1	/fire/ = 1
fuel	1	/fu/el/ = 2
hour	1	/hour/ = 1
interest	1	/in/ter/est/ = 3
individually	1	/in/di/vid/u/al/ly/ = 6

	No. Words	No. Syllables
iron	1	/ir/on/ = 2
language	1	/lan/guage/ = 2
listening	1	/lis/ten/ing/ = 3
maintenance	1	/main/ten/ance/ = 3
many	1	/ma/ny/ = 2
optical/electrical/ mechanical	1	/op/ti/cal/ /e/lec/tri/cal/ /me/chan/i/cal/ = 11
principally	1	/prin/cip/al/ly/ = 4
rail	1	/rail/ = 1
real	1	/re/al/ = 2
reel	1	/reel/ = 1
reliable	1	/rel/i/a/ble/ = 4
requirements	1	/re/quire/ments/ = 3
scheduling	1	/sched/ul/ing/ = 3
several	1	/sev/e/ral/ = 3
specifically	1	/spe/ci/fi/cal/ly/ = 5
steal	1	/steal/ = 1
summary	1	/sum/ma/ry/ = 3
toward	1	/to/ward/ = 2
undersirable	1	/un/de/sir/a/ble/ = 5
vertically	1	/ver/ti/cal/ly/ = 4
wheel	1	/wheel/ = 1
wire	1	/wire/ = 1

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* The phrase '1/8-in. stock" would be two words ("1/8-in." and "stock") and four syllables (/one/eighth/inch/stock/) because "1/8-in." is a compound adjective modifying or describing the noun "stock." In the phrase "1/8-in. long", "1/8" and "in." are both nouns (units of measure), so the phrase would consist of two words ("1/8-in." and "long") and six syllables (/one/eighth/of/an/inch/long/).

** If two or more options are listed under "No. Syllables", the first option is preferred.

APPENDIX C

READING GRADE LEVELS OF NAVY RATE TRAINING MANUALS (RTMs)

READING LEVELS
DERIVED
FROM
FLESCH & KINCAID
FORMULAE

NUMBER	TITLE	FLESCH AVG. GRADE LEVEL	KINCAID AVG. GRADE LEVEL
10054-D	Basic Military Requirements	10th - 12th	10.85
10056-C	Petty Officer 3 & 2	13th - 16th	11.83
10057-C	Military Requirements PO & C	13th - 16th	13.21
10058-A	Human Behavior & Leadership	10th - 12th	10.37
10059-B	The US Navy Shore Patrol	13th - 16th	12.25
10077-C	Blueprint Reading & Sketching	13th - 16th	11.52
10081-B	Standard First Aid Training Courses	10th - 12th	10.14
10085-B	Tools and Their Uses	8th - 9th	9.71
10105	Synchro, Servo and Gyro Fundamentals	13th - 16th	12.96
10115	Senior & Master Chief Petty Officer	13th - 16th	14.24
10120-F	Seaman	10th - 12th	10.17
10121-E	Boatswain's Mate 3 & 2	10th - 12th	9.94
10122-D	Boatswain's Mate 1 & C	8th - 9th	9.68
10126-C	Gunner's Mate 1 & C	College Grad.	15.41
10127	Electronic Warfare Tech 3 & 2 (C)	13th - 16th	13.89
10130-B	Introduction to Sonar	13th - 16th	10.91
10131-C	STG 3 & 2 (C)	13th - 16th	12.69
10132-B	Sonar Technician S 3 & 2	13th - 16th	11.18
10135-C	Signalman 3 & 2	13th - 16th	11.51
10136-B	Signalman 1 & C	13th - 16th	12.59
10140-D	ST 1 & C (C)	13th - 16th	13.53
10144-B	Radarman 3 & 2	13th - 16th	12.34

NUMBER	TITLE	FLESCH AVG. GRADE LEVEL	KINCAID AVG. GRADE LEVEL
10147-D	RD 1 & C	13th - 16th	12.65
10149-E	Quartermaster 3 & 2	10th - 12th	10.91
10151-C	Quartermaster 1 & C	13th - 16th	12.24
10153-C	Missile Tech. 3 & 2	13th - 16th	14.08
10154-B	MT 1 & C (C)	13th - 16th	13.07
10163-B	Torpedoman's Mate 3 & 2	10th - 12th	10.34
10164-A	Torpedoman's Mate 1 & C (C)	13th - 16th	14.56
10166-B	MN 3 & 2 (C)	10th - 12th	9.74
10167-B	MN 1 & C	10th - 12th	11.07
10185-A	Gunner's Mate G 3 & 2	10th - 12th	10.95
10186-C	Gunner's Mate G 1 & C	13th - 16th	12.74
10192-C	Electronics Tech 1 & C	13th - 16th	12.31
10193-C	Instrumentman 3 & 2	13th - 16th	11.59
10194-C	Instrumentman 1 & C	10th - 12th	11.52
10195	Electronics Tech. 3 & 2	13th - 16th	12.86
10195-A	Electronics Tech. 3 & 2 Vol. 1	College Grad.	14.52
10199-B	Gunner's Mate M 3 & 2	10th - 12th	10.24
10200-B	Gunner's Mate M 1 & C	13th - 16th	12.60
10201-A	Data Systems Tech 3 & 2	13th - 16th	13.50
10202-A	Data Systems Tech 1 & C	13th - 16th	14.73
10205-A	Opticalman 3 & 2	10th - 12th	11.05
10206-A	Opticalman 1 & C	13th - 16th	12.11
10207	Fire Control Tech G 3 & 2	13th - 16th	12.13
10207-A	Fire Control Tech G 3 & 2	13th - 16th	12.10
10208	Fire Control Tech G 1 & C	13th - 16th	12.37

NUMBER	TITLE	FLESCH AVG. GRADE LEVEL	KINCAID AVG. GRADE LEVEL
10209	Fire Control Technician M 3 & 2	13th - 16th	11.23
10209-S1	FTM 3 & 2 (Terrier) (Sup) (C)	13th - 16th	13.89
10209-S2	FTM 3 & 2 (M) Supplement (C)	13th - 16th	13.17
10209-S3	FTM 3 & 2 (Talos) (Sup) (C)	College Grad.	15.25
10210	FTM 1 & C (C)	13th - 16th	13.90
10210-S1	FTM (Terrier) 1 & C Supp I	13th - 16th	14.45
10210-S2	FTM 1 & C Supplement 2 (C)	13th - 16th	14.99
10210-S3	FTM 1 & C Supplement 3	13th - 16th	14.45
10211	Fire Control Tech B 3 & 2 (C)	13th - 16th	12.07
10212	Fire Control Tech B 1 & C	13th - 16th	12.77
10212-S1	FTB 1 & C Supp 1	13th - 16th	14.74
10212-S2	FTB 1 & C Supp 2 (C)	13th - 16th	13.79
10215-A	Postal Clerk 3 & 2	13th - 16th	13.56
10216-A	Postal Clerk 1 & C	13th - 16th	12.60
10228-F	Radioman 3 & 2	13th - 16th	12.63
10229-E	Radioman 1 & C	13th - 16th	14.12
10231-A	Communications Tech. TR1 3 & 2	13th - 16th	13.35
10232-A	Communication Tech. M 3 & 2	13th - 16th	14.13
10233-B	Communications Tech. A 3 & 2	13th - 16th	14.88
10235-B	Communications Tech., O 3 & 2	13th - 16th	12.69
10236-A	Communication Tech. M 1 & C	13th - 16th	13.43
10237-A	Communication Tech. A 1 & C	13th - 16th	13.64
10240-F	Yeoman 3 & 2	13th - 16th	13.45
10241-F	Yeoman 1 & C	13th - 16th	12.95
10254-C	Personnelman 3 & 2	13th - 16th	13.18

NUMBER	TITLE	FLESCH AVG. GRADE LEVEL	KINCAID AVG. GRADE LEVEL
10258-E	Personnelman 1 & C	13th - 16th	14.11
10264-B	Data Processing Tech 3 & 2	13th - 16th	12.46
10265-B	Data Processing Tech 1 & C	13th - 16th	13.46
10269-G	Storekeeper 3 & 2	13th - 16th	13.69
10270-E	Storekeeper 1 & C	13th - 16th	14.80
10274-F	Disbursing Clerk 3 & 2	13th - 16th	14.28
10275-E	Disbursing Clerk 1 & C	College Grad.	16.26
10279-E	Commissaryman 3 & 2	10th - 12th	10.95
10280-F	Commissaryman 1 & C	13th - 16th	11.97
10286-F	Ship's Serviceman 3 & 2	13th - 16th	12.89
10287-E	Ship's Serviceman 1 & C	13th - 16th	13.21
10292-A	Ship Servicemen's Handbook	10th - 12th	9.77
10294-B	Journalist 3 & 2	13th - 16th	12.07
10295-A	Journalist 1 & C	13th - 16th	12.92
10300-C	Boatswain's Mate H 3 & 2	13th - 16th	11.32
10301-C	Boatswain's Mate F 3 & 2	13th - 16th	11.25
10303-B	Boatswain's Mate H 1 & C	13th - 16th	12.79
10304-B	Boatswain's Mate F 1 & C	13th - 16th	12.64
10305-B	Boatswain's Mate E 1 & C	13th - 16th	13.00
10306-C	Boatswain's Mate E 3 & 2	13th - 16th	12.81
10307-C	Airman	13th - 16th	11.43
10308-C	Structural Mechanic S 3 & 2	10th - 12th	11.26
10309-C	Structural Mechanic E 3 & 2	13th - 16th	12.77
10310-B	Structural Mechanic H 3 & 2	13th - 16th	11.75
10311-B	Structural Mechanic S 1 & C	13th - 16th	13.11

NUMBER	TITLE	FLESCH AVG. GRADE LEVEL	KINCAID AVG. GRADE LEVEL
10312-B	Structural Mechanic E 1 & C	13th - 16th	13.67
10313-B	Structural Mechanic H 1 & C	13th - 16th	14.97
10314-A	Support Equipment Tech. E 3 & 2	13th - 16th	12.36
10315-A	Support Equipment Tech. M 3 & 2	13th - 16th	11.74
10316-A	Support Equipment Tech. H 3 & 2	13th - 16th	11.43
10317-D	Av. Electronics Tech. 3 & 2	13th - 16th	13.04
10318-D	Av. Electronics Tech. 1 & C	13th - 16th	13.85
10321-A	Support Equipment Tech. 1 & C	13th - 16th	13.39
10341-B	Machinist's Mate J 3 & 2	13th - 16th	12.21
10342-A	Machinist's Mate R 3 & 2	13th - 16th	12.52
10343-C	Machinist's Mate J 1 & C	13th - 16th	13.94
10344-A	Machinist's Mate R 1 & C	13th - 16th	13.11
10345-C	Ordnanceman 3 & 2	13th - 16th	12.23
10347-C	Ordnanceman 1 & C	13th - 16th	12.78
10348-C	Electrician's Mate 3 & 2	13th - 16th	12.93
10349-C	Electrician's Mate 1 & C	13th - 16th	14.41
10350	ASW Operator 3 & 2	13th - 16th	12.57
10351	ASW Operator 1 & C	13th - 16th	13.42
10353-B	ASW Technician 3 & 2	13th - 16th	12.87
10354-B	A & W Technician 1 & C	College Grad.	14.42
10355-A	Photographer's Mate 3 & 2	10th - 12th	11.41
10358-D	Survival Equipment 3 & 2	10th - 12th	10.68
10360-D	Aircrew Survival Equipmentman	13th - 16th	11.45
10362-A	Aerographer's Mate 1 & C	13th - 16th	14.25
10363-D	Aerographer's Mate 3 & 2	13th - 16th	12.72

NUMBER	TITLE	FLESCH AVG. GRADE LEVEL	KINCAID AVG. GRADE LEVEL
10367-E	Air Controlman 3 & 2	13th - 16th	14.06
10368-D	Air Controlman 1 & C	College Grad.	15.14
10369-B	PI 3 & 2 (C)	13th - 16th	12.39
10370-A	PI 1 & C (C)	13th - 16th	14.58
10376-C	Tradevman 3 & 2	13th - 16th	11.67
10378-C	Tradevman 1 & C	13th - 16th	13.04
10387-A	Fire Control Tech 3 & 2	13th - 16th	12.48
10390-C	Fire Control Tech 1 & C	13th - 16th	14.12
10391-B	Maintenance Adm. 3 & 2	College Grad.	15.13
10392-A	Maintenance Adm. 1 & C	13th - 16th	13.42
10398-D	Storekeeper 3 & 2	College Grad.	15.50
10399-D	Storekeeper 1 & C	13th - 16th	15.08
10452-B	Lithographer 3 & 2	10th - 12th	10.34
10454-B	Lithographer 1 & C	10th - 12th	10.27
10469-A	Illustrator Draftsman 3 & 2	10th - 12th	10.53
10470-A	Illustrator Draftsman 1 & C	10th - 12th	9.90
10479	Seabee Combat Handbook	13th - 16th	11.22
10520-D	Fireman	10th - 12th	10.79
10524-D	Machinist's Mate 3 & 2	13th - 16th	12.33
10525-C	Machinist's Mate 1 & C	13th - 16th	12.18
10530-D	Machinery Repairman 3 & 2	10th - 12th	10.52
10531-C	Machinery Repairman 1 & C	13th - 16th	12.63
10535-F	Boiler Tech 3 & 2	13th - 16th	11.84
10536-E	Boiler Tech 1 & C	13th - 16th	12.57
10537-B	Boilermaker 1 & C	10th - 12th	11.34

NUMBER	TITLE	FLESCH AVG. GRADE LEVEL	KINCAID AVG. GRADE LEVEL
10541-B	Engineman 3 & 2	10th - 12th	11.16
10543-D	Engineman 1 & C	13th - 16th	14.00
10546-C	Electricians Mate 3 & 2	13th - 16th	12.49
10547-C	Electricians Mate 1 & C	13th - 16th	14.47
10557-D	I. C. Electrician 1 & C	13th - 16th	13.90
10558-A	I. C. Electrician 3 & 2	13th - 16th	12.59
10573	Hull Maintenance Tech 3 & 2	10th - 12th	10.72
10574	Hull Maintenance Tech 1 & C	13th - 16th	12.90
10578-B	Patternmaker 3 & 2	10th - 12th	9.80
10579-B	Patternmaker 1 & C	10th - 12th	10.75
10584-C	Molder 3 & 2	10th - 12th	10.90
10585-B	Molder 1 & C	13th - 16th	12.45
10624-A	Basic Machines	8th - 9th	8.82
10630-E	Constructionman	10th - 12th	10.34
10634-B	Engineering Aid 3 & 2	13th - 16th	12.19
10635-a	Engineering Aid 1 & C	13th - 16th	14.16
10636-G	Construction Electrician 3 & 2	10th - 12th	10.89
10637-D	Construction Electrician 1 & C	13th - 16th	12.72
10640-G	Equipment Operator 3 & 2	10th - 12th	11.31
10641-F	Equipment Operator 1 & C	13th - 16th	13.08
10644-F	Construction Mechanic 3 & 2	10th - 12th	10.40
10645-D	Construction Mechanic 1 & C	13th - 16th	11.52
10648-F	Builder 3 & 2	10th - 12th	11.03
10649-E	Builder 1 & C	13th - 16th	12.77
10653-E	Steelworker 3 & 2	10th - 12th	10.11

NUMBER	TITLE	FLESCH AVG. GRADE LEVEL	KINCAID AVG. GRADE LEVEL
10654-D	Steelworker 1 & C	13th - 16th	13.17
10656-F	Utilitiesman 3 & 2	13th - 16th	12.16
10657-D	Utilitiesman 1 & C	13th - 16th	12.72
10664-B	Hospitalman	13th - 16th	10.88
10669-A	Hospital Corpsman 3 & 2	13th - 16th	13.03
10670-A	Hospital Corpsman 1 & C	13th - 16th	14.95
10681	Dentalman	13th - 16th	11.73
10682	Dental Tech 3 & 2	13th - 16th	13.65
10683	Dental Tech 1 & C	College Grad.	14.96
10685-C	Dental Tech., Prosthetic	13th - 16th	11.76
10687-C	Dental Tech., Repair	13th - 16th	11.30
10694-D	Steward 3 & 2	10th - 12th	10.26
10695-D	Steward 1 & C	13th - 16th	12.11

APPENDIX D

READING GRADE LEVELS OF NAVY NON-RESIDENT CAREER COURSES (NRCCs)

READING LEVELS
DERIVED
FROM
FLESCH FORMULA

NUMBER	TITLE	FLESCH AVG. GRADE LEVEL
91202-1F	Basic Military Requirements	10th - 12th
91206-1A	Military Req. for Petty Officer 3 & 2	13th - 16th
91207-G	Military Req. for Petty Officer 1 & C	13th - 16th
91209	Mil. Req. for Senior & Master CPO	13th - 16th
91216-A	Seabee Combat Handbook	10th - 12th
91217-H	Standard First Aid Training Course	8th - 9th
91223-3B	Blueprint Reading and Sketching	10th - 12th
91228-2A	Tools and Their Uses	8th - 9th
91229	Electronics Test Methods and Practices	13th - 16th
91230-F	Basic Machines	10th - 12th
91233	Data Systems Tech 3 & 2	13th - 16th
91234-B	DS 1 & C (C)	13th - 16th
91236	Electronics Technician 3 & 2	13th - 16th
91238	Human Behavior & Leadership	10th - 12th
91240-1H	Seaman	8th - 9th
91243-2C	Boatswain's Mate 3 & 2	10th - 12th
91245-2D	Boatswain's Mate 1 & C	8th - 9th
91249	Hull Maintenance Tech 1 & C	13th - 16th
91253-E	Quartermaster 1 & C	10th - 12th
91258-C	Introduction to Sonar	13th - 16th
91259-5	Sonar Tech S 3 & 2	13th - 16th
91261-1D	STG 3 & 2 (C)	13th - 16th

NUMBER	TITLE	FLESCH AVG. GRADE LEVEL
91265-1	ST 1 & C (C)	10th - 12th
91268-1A	RD 1 & C (C)	13th - 16th
91269-1B	RD 3 & 2	10th - 12th
91272	ET 3 & 2 (C)	13th - 16th
91274-1C	Data Processing Tech 3 & 2	13th - 16th
91275-1A	Data Processing Tech 1 & C	13th - 16th
91286-3	Quartermaster 3 & 2	10th - 12th
91291-F	Signalman 3 & 2	10th - 12th
91292-1A	Signalman 1 & C	13th - 16th
91297-F	TM 3 & 2 (C)	13th - 16th
91299-2	Torpedoman's Mate 1 & C	13th - 16th
91310	Fire Control Tech. B 3 & 2	13th - 16th
91315	FT (B) 1 & C (C)	13th - 16th
91315-S1	Fire Control Tech. (B) 1 & C	13th - 16th
91315-S2	FT B 1 & C Supp. 2	13th - 16th
91333	Synchro, Servo, & Gyro Fundamentals	13th - 16th
91335-3	Mineman 3 & 2	10th - 12th
91337-2D	Mineman 1 & C	10th - 12th
91341-1	Fire Control Tech. G 3 & 2	13th - 16th
91341-1	FTG 3 & 2 Achievement Tests	13th - 16th
91342	FTM 3 & 2 (C)	13th - 16th
91347	Fire Control Tech. (G) 1 & C	13th - 16th
91348	Fire Control Tech. G 3 & 2	10th - 12th
91349	FT (M) 3 & 2 (Terrier Sup. 1)	13th - 16th
91350-S2	FTM 3 & 2 (Tartar)	10th - 12th

NUMBER	TITLE	FLESCH AVG. GRADE LEVEL
91351	Fire Control Tech (M) 3 & 2	13th - 16th
91355-3	Gunner's Mate 3 & 2	10th - 12th
91357-2	Gunner's Mate Guns 1 & C	13th - 16th
91358	Fire Control Tech M 1 & C	13th - 16th
91358-S1	FT (M) 1 & C (Terrier)	13th - 16th
91358-S2	Fire Control Tech M 1 & C	13th - 16th
91358-S3	Fire Control Tech M 1 & C	13th - 16th
91360-2B	Missile Tech 3 & 2	13th - 16th
91361-2	Missile Tech 1 & C	13th - 16th
91364-C	Structural Mechanics S 3 & 2	10th - 12th
91365-B	Structural Mechanic H 3 & 2	10th - 12th
91367-1	Structural Mechanic H 1 & C	13th - 16th
91368-B	Aviation Machinist's Mate 3 & 2 R	13th - 16th
91375-3A	Electronics Tech 3 & 2	13th - 16th
91376-E	Electronics Tech 1 & C	13th - 16th
91378-D	GMT 1 & C (C)	13th - 16th
91379-B	Gunner's Mate Missiles 3 & 2	10th - 12th
91380-B	Gunner's Missiles 1 & C	13th - 16th
91383-1	Instrumentman 3 & 2	13th - 16th
91385-2	Instrumentman 1 & C	10th - 12th
91386-B	Opticalman 3 & 2	10th - 12th
91389-2	Opticalman 1 & C	13th - 16th
91393	Dentalman	13th - 16th
91403-3	Radioman 3 & 2	13th - 16th
91405-3C	Radioman 1 & C	13th - 16th

NUMBER	TITLE	FLESCH AVG. GRADE LEVEL
91408-A	Av. Support Equipment Tech M 3 & 2	13th - 16th
91409-A	Av. Support Equipment Tech H 3 & 2	13th - 16th
91410-A	Av. Support Equipment Tech E 3 & 2	13th - 16th
91411-1	Av. Support Equipment Tech 1 & C	13th - 16th
91414-3G	Yeoman 3 & 2	13th - 16th
91416-4	Yeoman 1 & C	13th - 16th
91420-2	Personnelman 3 & 2	13th - 16th
91422-2B	Personnelman 1 & C	13th - 16th
91431-4	Storekeeper 3 & 2	13th - 16th
91433-3	Storekeeper 1 & C	13th - 16th
91436-4A	Disbursing Clerk 3 & 2	13th - 16th
91438-3B	Disbursing Clerk 1 & C	13th - 16th
91438-3B	Supp. Disbursing Clerk 1 & C	13th - 16th
91441-1F	Commissaryman 3 & 2	10th - 12th
91443-3	Commissaryman 1 & C	13th - 16th
91447-2	Ship's Serviceman 3 & 2	13th - 16th
91450-E	Ship's Serviceman 1 & C	10th - 12th
91452-2	Journalist 3 & 2	10th - 12th
91453-1A	Journalist 1 & C	13th - 16th
91460-1A	Postal Clerk 1 & C	13th - 16th
91463-1G	Ship's Serviceman Tailor	8th - 9th
91465-1C	Ship's Serviceman Barber	8th - 9th
91466-F	Ship's Serviceman Laundry	10th - 12th
91468-1F	The U. S. Navy Shore Patrol	10th - 12th
91471-1C	Lithographer 3 & 2	8th - 9th

NUMBER	TITLE	FLESCH AVG. GRADE LEVEL
91475-1F	Lithographer 1 & C	10th - 12th
91488-2	Illustrator Draftsman 3 & 2	13th - 16th
91489-2	Illustrator Draftsman 1 & C	10th - 12th
91493-1B	Photographers Mate 3 & 2	10th - 12th
91498-C	Maintenance Adm. 3 & 2	13th - 16th
91499-1	Maintenance Adm. 1 & C	13th - 16th
91500-2F	Fireman	13th - 16th
91502-3	Machinist's Mate 3 & 2	13th - 16th
91504-F	Machinist's Mate 1 & C	13th - 16th
91507-2C	Machinery Repairman 3 & 2	8th - 9th
91509-2D	Machinery Repairman 1 & C	10th - 12th
91510	Hull Maintenance Tech 3 & 2	10th - 12th
91512-4A	Boiler Technician 3 & 2	13th - 16th
91514-4	Boiler Technician 1 & C	13th - 16th
91515-1A	Boilermaker 1 & C	13th - 16th
91519-2B	Engineman 3 & 2	10th - 12th
91521-J	Engineman 1 & C	13th - 16th
91524-2	Electrician's Mate 3 & 2	13th - 16th
91526-1E	Electrician's Mate 1 & C	13th - 16th
91529-1B	Interior Communications Electrician 3 & 2	10th - 12th
91531-2	I. C. Electrician 1 & C	13th - 16th
91547-C	Communications Tech O 3 & 2	13th - 16th
91549-1A	Patternmaker 3 & 2	8th - 9th
91551-C	Patternmaker 1 & C	10th - 12th
91552	Av. Antisubmarine Warfare Op. 1 & C	College Grad.

NUMBER	TITLE	FLESCH AVG. GRADE LEVEL
91554-2	Molder 3 & 2	10th - 12th
91556-1B	Molder 1 & C	13th - 16th
91557-C	Communications Tech M 3 & 2	13th - 16th
91558-D	Communications Tech A 3 & 2	13th - 16th
91560-A	Communications Tech A 1 & C	13th - 16th
91561-B	Communications Tech M 1 & C	13th - 16th
91562-2B	Constructionman	10th - 12th
91564-3B	Engineering Aid 3 & 2	13th - 16th
91566-3	Engineering Aid 1 & C	13th - 16th
91567-1A	Communications Tech TR&I 3 & 2	13th - 16th
91569-2E	Construction Electrician 3 & 2	10th - 12th
91571-1H	Construction Electrician 1 & C	13th - 16th
91574-4	Equipment Operator 3 & 2	10th - 12th
91576-2F	Equipment Operator 1 & C	13th - 16th
91577-C	AX 3 & 2 (C)	13th - 16th
91579-2A	Construction Mechanic 3 & 2	10th - 12th
91581-2C	Construction Mechanic 1 & C	13th - 16th
91582-B	Machinist's Mate J 3 & 2	13th - 16th
91584-2D	Builder 3 & 2	8th - 9th
91586-4	Builder 1 & C	13th - 16th
91587-D	Machinist's Mate J 1 & C	13th - 16th
91589-2A	Steelworker 3 & 2	10th - 12th
91591-2	Steelworker 1 & C	10th - 12th
91592-C	Photographers Intelligenceman 3 & 2	13th - 16th
91594-3	Utilitiesman 3 & 2	13th - 16th

NUMBER	TITLE	FLESCH AVG. GRADE LEVEL
91475-1F	Lithographer 1 & C	10th - 12th
91488-2	Illustrator Draftsman 3 & 2	13th - 16th
91489-2	Illustrator Draftsman 1 & C	10th - 12th
91493-1B	Photographers Mate 3 & 2	10th - 12th
91498-C	Maintenance Adm. 3 & 2	13th - 16th
91499-1	Maintenance Adm. 1 & C	13th - 16th
91500-2F	Fireman	13th - 16th
91502-3	Machinist's Mate 3 & 2	13th - 16th
91504-F	Machinist's Mate 1 & C	13th - 16th
91507-2C	Machinery Repairman 3 & 2	8th - 9th
91509-2D	Machinery Repairman 1 & C	10th - 12th
91510	Hull Maintenance Tech 3 & 2	10th - 12th
91512-4A	Boiler Technician 3 & 2	13th - 16th
91514-4	Boiler Technician 1 & C	13th - 16th
91515-1A	Boilermaker 1 & C	13th - 16th
91519-2B	Engineman 3 & 2	10th - 12th
91521-J	Engineman 1 & C	13th - 16th
91524-2	Electrician's Mate 3 & 2	13th - 16th
91526-1E	Electrician's Mate 1 & C	13th - 16th
91529-1B	Interior Communications Electrician 3 & 2	10th - 12th
91531-2	I. C. Electrician 1 & C	13th - 16th
91547-C	Communications Tech O 3 & 2	13th - 16th
91549-1A	Patternmaker 3 & 2	8th - 9th
91551-C	Patternmaker 1 & C	10th - 12th
91552	Av. Antisubmarine Warfare Op. 1 & C	College Grad.

NUMBER	TITLE	FLESCH AVG. GRADE LEVEL
91554-2	Molder 3 & 2	10th - 12th
91556-1B	Molder 1 & C	13th - 16th
91557-C	Communications Tech M 3 & 2	13th - 16th
91558-D	Communications Tech A 3 & 2	13th - 16th
91560-A	Communications Tech A 1 & C	13th - 16th
91561-B	Communications Tech M 1 & C	13th - 16th
91562-2B	Constructionman	10th - 12th
91564-3B	Engineering Aid 3 & 2	13th - 16th
91566-3	Engineering Aid 1 & C	13th - 16th
91567-1A	Communications Tech TR&I 3 & 2	13th - 16th
91569-2E	Construction Electrician 3 & 2	10th - 12th
91571-1H	Construction Electrician 1 & C	13th - 16th
91574-4	Equipment Operator 3 & 2	10th - 12th
91576-2F	Equipment Operator 1 & C	13th - 16th
91577-C	AX 3 & 2 (C)	13th - 16th
91579-2A	Construction Mechanic 3 & 2	10th - 12th
91581-2C	Construction Mechanic 1 & C	13th - 16th
91582-B	Machinist's Mate J 3 & 2	13th - 16th
91584-2D	Builder 3 & 2	8th - 9th
91586-4	Builder 1 & C	13th - 16th
91587-D	Machinist's Mate J 1 & C	13th - 16th
91589-2A	Steelworker 3 & 2	10th - 12th
91591-2	Steelworker 1 & C	10th - 12th
91592-C	Photographers Intelligenceman 3 & 2	13th - 16th
91594-3	Utilitiesman 3 & 2	13th - 16th

NUMBER	TITLE	FLESCH AVG. GRADE LEVEL
91596-3A	Utilitiesman 1 & C	13th - 16th
91600-E	Airman	10th - 12th
91603-1A	Aerographer's Mate 1 & C	13th - 16th
91606-1E	Aircrew Survival Equipmentman 1 & C	13th - 16th
91608-2	Av. Machinist's Mate R 1 & C	10th - 12th
91610-1F	Electrician's Mate 3 & 2	13th - 12th
91611-2C	Electrician's Mate 1 & C	13th - 16th
91613-2B	Electronics Tech 3 & 2	13th - 16th
91615-F	Electronics Tech 1 & C	13th - 16th
91622-2	Av. Structural Mechanic E 3 & 2	13th - 16th
91634-3A	Fire Control Tech 3 & 2	13th - 16th
91635-2C	Av. Fire Control Tech 1 & C	13th - 16th
91636-1E	Av. Boatswain's Mate H 3 & 2	13th - 16th
91638-1B	Av. Boatswain's Mate H 1 & C	13th - 16th
91649-D	Photographer's Mate 1 & C	13th - 16th
91650-1D	Av. Structural Mech S 1 & C	13th - 16th
91662-3	Av Ordnanceman 1 & C	13th - 16th
91665-2C	Av. Ordnanceman 3 & 2	10th - 12th
91667-1D	Hospitalman	10th - 12th
91669-3	Hospital Corpsman 3 & 2	13th - 16th
91671-2	Hospital Corpsman 1 & C	13th - 16th
91672-C	Av. Boatswain's Mate E 1 & C	13th - 16th
91674-1A	Av. Storekeeper 3 & 2	13th - 16th
91675-1D	Av. Storekeeper 1 & C	13th - 16th
91676-1D	Air Controlman 3 & 2	13th - 16th

NUMBER	TITLE	FLESCH AVG. GRADE LEVEL
91677-D	Air Controlman 1 & C	13th - 16th
91678-D	Av. Boatswain's Mate E 3 & 2	13th - 16th
91679-D	Av. Boatswain's Mate F 3 & 2	13th - 16th
91680-B	Av. Boatswain's Mate F 1 & C	13th - 16th
91681-2	Dental Technician 3 & 2	13th - 16th
91683-1	PT 1 & C	13th - 16th
91686-1C	Dental Technician, Prosthetic 3 & 2	13th - 16th
91687-1D	Dental Tech., Prosthetic 1 & C	10th - 12th
91688	AW 3 & 2	13th - 16th
91689-2A	Dental Technician, Repair	10th - 12th
91690	Dental Tech., 1 & C	13th - 16th
91693-3A	Steward 3 & 2	10th - 12th
91696-G	Steward 1 & C	10th - 12th
91697-C	Av. Antisubmarine Warfare Tech 1 & C	13th - 16th
91698-1C	Tradevman 3 & 2	13th - 16th
91699-D	Tradevman 1 & C	13th - 16th